RESOURCE POTENTIALITIES OF WETLANDS: A CASE STUDY OF RAYAN MOUZA OF BURDWAN -1 BLOCK, WEST BENGAL

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Abstract: Wetlands are essential elements of the environment. Between deep water and upland ecosystems, they serve as an ecotone and an interface. Therefore, scientists refer to these places as "cradles of biodiversity", "biological supermarkets", "kidneys of landscape", "repository of resources", etc. to recognise their multi-tasking role. It is needless to say that a developing country like India and a state like West Bengal, where land is ploughed up over centuries for crop cultivation, studies are necessary to create more avenues, inter alia, to generate superior resources even from hitherto under-utilized sources. Although it has been discovered that these wetlands are a rich source of aquatic flora and wildlife, neither their economic utilisation nor growth orientation is adequate. Therefore, the primary goals of the current study are to identify the resource potential of the study area's wetlands and to propose strategies for more advantageous uses of wetlands from an environmental and economic perspective. Both primary and secondary data have been created and utilised with the aim of evaluating their resource potentialities and their capacity to provide diverse economic applications.

Index Terms - Wetland, Resource potentiality, Economic utilization

I. INTRODUCTION

Wetlands are essential elements of the environment. Between deep water and upland ecosystems, they serve as an ecotone and an interface. These serve as reservoirs for two essential elements of the environment: water and aquatic life. They are also important natural sinks for pollutants and sources of groundwater recharge (Mitsch et al., 1986). According to Chaudhuri (1998), wetlands are among the most productive and biologically diverse ecosystems. These are resources that belong to everyone and are considered Common Property Resources (CPR) (Singh, 2015). While some of these wetlands' resources are well-known and have a long history, others are underutilised, undeveloped, or exotic in character. According to the Ramsar Convention wetland is defined as "areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt water, including areas of marine water, the depth of which at low tide does not exceed six metres" (MedWet, 2016). The National Wetland Conservation Programme (NWCP), implemented by the Govt. of India in close collaboration with the respective State Government since 1985-86, considers wetlands as areas where water is the primary factor controlling the environment and the associated plant and animal life. It further states that wetlands, natural and manmade, fresh water or brackish, provide numerous ecological services (GoI, NWCP).

Due to its diverse physiographic and climatic features, India has a wide range of wetlands and aquatic habitat. In recent years, more focus has been placed on researching a wide range of topics, including wetland ecosystems (Vijayan and Vijayan, 2003), their ethno-botanical aspects (Verma and Shringi, 2005), wetland restoration (Rajnikanth et al., 2000), the medicinal applications of wetland plants (Sunil Kumar and Thomas, 2007), and others. Another emerging field of geographic research is the economic assessment of wetlands. Verma, Madhu (2001) undertook such a study of Bhoj wetland in Bhopal. Singh, et.al., (2015) in their study on Common Property Resources and Rural People of Awadh, Terai have explained the social and economic importance of wetlands. The said Common Property Resource (CPR), to the village folk in Awadh region of Upper Ganga Plains, India, can generate employment. That wetlands can generate resources of importance can be known from the guidelines and works of FAO (2005,1978), and Wagner (1997) who reviewed the biology and utilization of wetland macrophytes including Azolla. Barbier et.al., (1997) emphasized on the economic valuation of wetlands and in the process underscored the policy aspect of wetland utilization.

The mission of the Ramsar Convention, as adopted in 1999 and refined in 2005 and 2011, centres on the conservation and wise use of all wetlands through sustainable local, regional, national, and international actions (MedWet, 2016). In this respect evaluation of resource potentiality of wetlands is very necessary.

Geographers, planners, hydrologists, botanists, and scientists from related disciplines have made significant academic contributions to the main fields of wetland research in India and abroad for almost the last 25 years, undoubtedly assisting in the expansion of domain knowledge on wetlands around the world. These research areas are as many and diverse as the researchers who work in them. Although the aforementioned research areas are varied and multifaceted, there aren't many studies on their economic significance, particularly with regard to their resource potentialities. The present study of the wetlands of Rayan mouza of Burdwan -1 Block; West Bengal with reference to resource potentialities is relevant in this context. The inquiry has the attributes of a pilot study as it shows how wetlands - the water bodies as well as parcels of land around them - can be used for several economically gainful purposes.

II. OBJECTIVE

Although it has been discovered that these wetlands are a rich source of aquatic flora and wildlife, neither their economic utilisation nor growth orientation is adequate. They can only be used for two specific purposes: (a) irrigation from wetlands during the dry season, especially for the Rabi crop, and (b) the production of table fish and fish seed through pisciculture in culturable wetlands under the supervision of the Fisheries Department, GoWB, and private owners of water bodies. Aquatic macrophytes, however, are abundant in these wetlands and can be grown for new cash crops, vegetables, animal feed, biofertilizer, as well as raw materials with significant medical and pharmaceutical value (IWMED, 1998). Irrigation and culture of fish apart, there is prospect of fresh water pearl culture (IPCC, 2010), and through a combination of Pisciculture-and Participatory Agriculture, there is scope of extension of Micro-Small and Medium Enterprises (MSME). Hence, wetlands of the study area though potential in resources, yet these are either untapped or under-utilized. So, the main objectives of the present study:

i) To find out resource potentialities of wetlands of the study area.

ii) To suggest ways and means for better uses of wetlands from environmental and economic points of view.

III STUDY AREA

The district of Burdwan is centrally located in the heart of the state of West Bengal, India. It is located between 22^0 56' North and 23^0 53' North latitudes and between 86^0 48' East and 88^0 25'East longitudes.

Rayan mouza is situated near the Burdwan main town. It is located between 23^0 15' North and $23^0$16' 50" North latitudes and between 87^0 52.50" East and 87^0 55.50" East longitudes. Total area of this mouza is 10.2077 sq km or 1020.77 ha. This mouza has 64 no of wetlands. All these are concentrated in surrounding the settlement. Some of which are located beside the main Burdwan- Katoa roadway. This location is an important factor for proper development of a wetland.

Rayan *mouza* falls under Burdwan-I CD Block. It contains maximum number of wetlands (64 wetlands each above 0.5 ha.) among all other *mouzas* of the said block. Here wetlands cover an area of 59.66 ha. Rayan mouza lies to the west of Burdwan town and the township is situated in its close proximity. All the wetlands in this mouza are manmade and perennial in nature. The wetlands are mainly clustered in the central part of Rayan. These are mostly under private ownership. Water bodies are mainly considered as source of irrigation during the lean period. Source of water in these wetlands is either run off or canal water. Some of the wetlands are situated along the Burdwan-Katoa roadway. *Sona dighi, Nero dighi, Bijoyram pukur, Kha pukur* are some of the large wetlands of this mouza (Fig. 1).

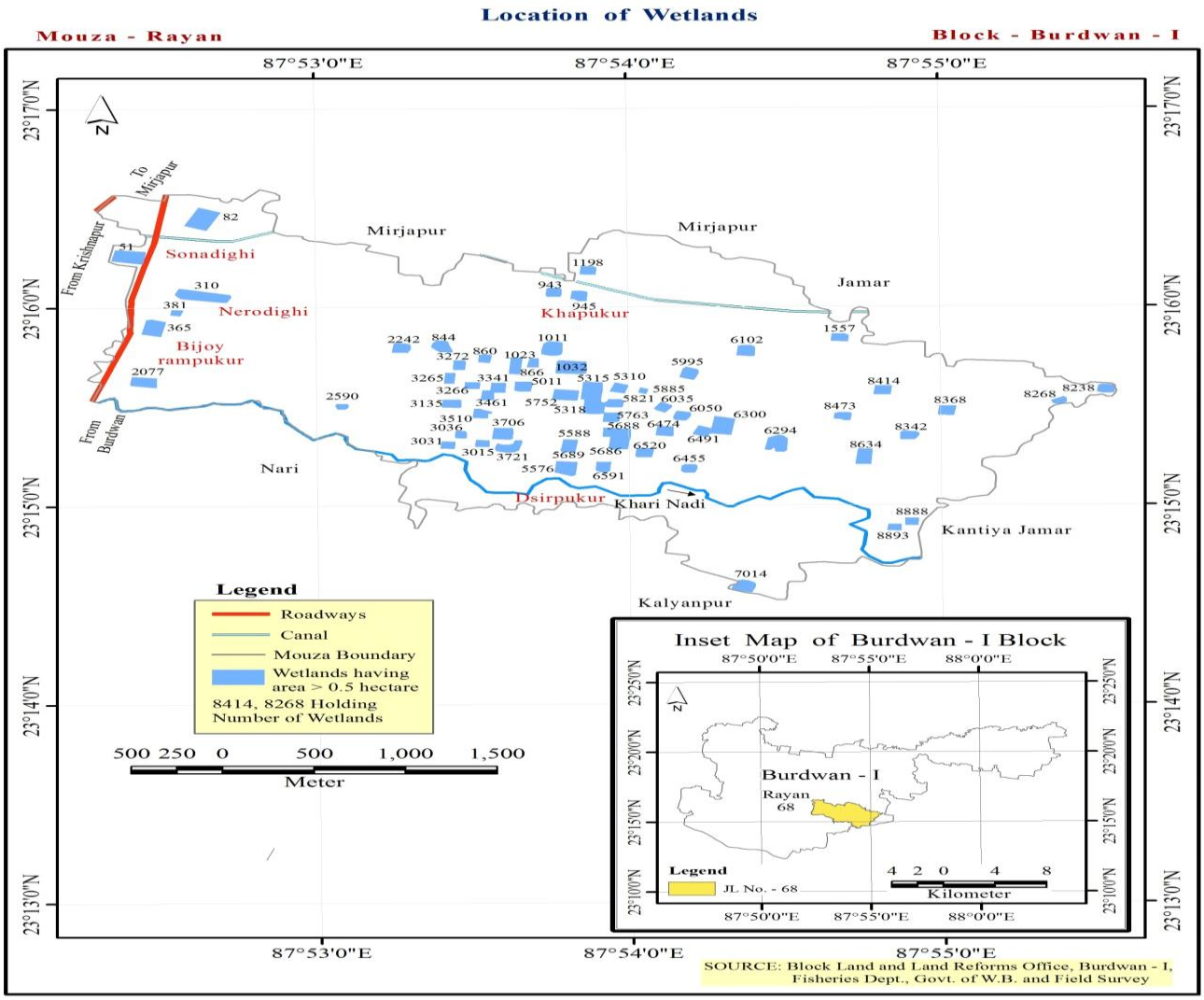

Fig. 1: Location of the study area and location of wetlands

IV DATA SOURCE AND METHODOLOGY

The present study is built on a foundation of primary and secondary data. Both primary and secondary data have been created and utilised with the aim of evaluating their resource potentialities and their capacity to provide diverse economic applications.

The present study takes into account a total of 64 wetlands each having an area more than 0.5 hectare (ha) [i.e.,5, 000 sq. meters]. The study area is containing maximum number and maximum area under wetlands for detailed study. On the basis of purposive random sampling method some sample wetlands have been taken into consideration for detailed study. Moreover, by selecting the village (*mouza*) having both the greatest number of wetlands and maximum area under wetlands in Burdwan -1 CD Block, the present study has assumed more reliability and significance both from qualitative and quantitative considerations.

The method of assessing the resource potentialities of wetlands is therefore primarily based on testing the physical and chemical properties of water and soil in order to match them with the existing wetland biodiversity as described in the following:

(i) Testing the physical and chemical properties of water taken as sample from the wetlands of the study area. Water samples were tested on Temperature, Transparency, Volume of plankton, Free CO_2, Dissolved Oxygen, and Phosphate;

(ii) Testing the physical and chemical properties of soil taken as sample from the wetlands of the study area. Soil samples were tested on soil pH, Organic Carbon, Nitrate Nitrogen, Ammoniacal Nitrogen, and Phosphate;

(iii) Matching the water and soil sample results with the prevailing biological diversity of the wetlands;

(iv) Finding out the productivity of wetlands based on water and soil testing data. The productivity scales are as per the Fisheries Department, Govt. of West Bengal (Table 1 and 2) and are given as follows:

Table 1: Scale of productivity of water in wetlands/ water bodies in study area

Productivity of water in wetlands/ water bodies				
Parameters	pH	TotalAlkalinity (mg/ litre)	Availablephosphate (mg/ 100g)	Productivity statues
Range	7.5-8.0	≥150	≥1.5	High
	7.0-7.5	50-150	0.5-1.0	Medium
	6.5-7.0	<50	<0.5	Low

Source: Fisheries Department, Govt. of West Bengal

(v) Establishing combined productivity of water and soil and finding out suitability/ potentiality of resources as are recoded to be available from the wetlands of the study area. The combined productivity scale of water and soil is given herein under (Table 3).

Table 3: Scale of combined productivity of water and soil in wetlands/ water bodies in study area

Combined Productivity	Parameters						
	Soil			Water			Soil/ Water
	Organic Carbon (mg/ 100g))	Ammoniacal Nitrogen (mg/100gm)	Available phosphate (mg/100gm)	pH	Total Alkalinity (mg/litre)	Phosphate (mg/litre)	Total Score
HIGH (12-18)	>2 Score-3	(36-50) Score-3	≥13 Score-3	7.5-8 Score-3	>150 Score-3	>1.5 Score-3	18
MEDIUM (6-12)	1-2 Score-2	(21-36) Score-2	7-12.9 Score-2	7-7.5 Score-2	50-150 Score-2	0.5-1.5 Score-2	12
LOW (<6)	<1 Score-1	(0-21) Score-1	0-6.9 Score-1	6.5-7 Score-1	<50 Score-1	<0.5 Score-1	6

Source: Based on Table 1 and 2

VI DISCUSSION AND RESULT

Physico-chemical properties of water and soil have been examined and the observations are discussed as follows:

6.1 Physico-chemical properties of water

(1) Colour of water in wetlands varies from opaque to transparent. It also grades from greenish to brownish in colour. Water in most of the water bodies is greenish to greenish yellow.

(2) Water in wetlands is lukewarm. Temperature ranges between 26^0 C and 34.5^0C.

(3) pH of water is a measure for hardness of water. It has been found to vary from slightly acidic to moderately alkaline.

(4)) Total alkalinity (mg/litre) in water is a measure for the sensitivity of water to acid inputs as well as for the ability of water to neutralize acidic pollution from waste water. It has been found to vary

generally from 30 – 100. High alkalinity (> 150) occurs in some wetlands of this mouza. High total alkalinity helps to attain high productivity of water.

(5) Free CO_2 (mg/litre) in water is an indicator of improved plant growth while aquatic flora and fauna are stressed by low CO_2 level. It ranges, in general, from 3-10mg/litre in wetland waters of the study area.

(6) Dissolved oxygen (mg/litre) in water is another measure for water productivity. It varies generally from 1.0-5.0 mg/litre.

Phosphate (mg/litre) in water varies from medium to high (0.5 -6.0) in most of the wetlands of the study area. In fact, productivity directly proportional, inter alia, to its phosphate content (Fig.2). of water is

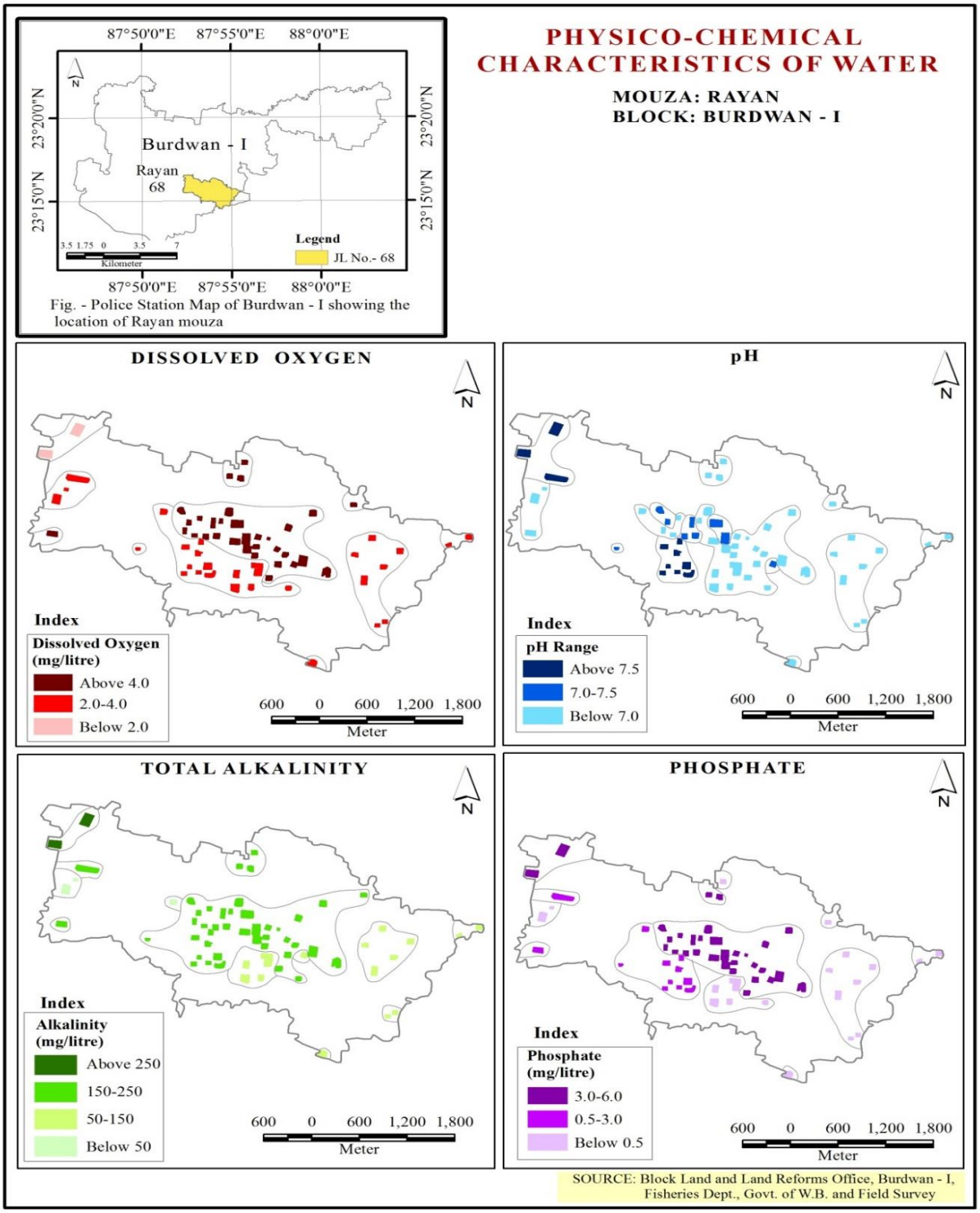

Fig.2: Mouza – Rayan, Block – Burdwan - I

6.2 PHYSICO-CHEMICAL PROPERTIES OF SOIL

(1) Soil in wetlands of the study area is generally loamy and clayey in character.

(2) Soil pH identifies prevalence of an acidic soil in the wetlands of the study area. Soil pH has generally been found to vary between 5.5-6.5. Organic carbon (mg/100g) in soil is a measure for soil fertility including physical, chemical and biological fertility. Soil organic carbon when decomposed supplies nutrients for plant growth. Quantity varies among the concerned wetlands.

(3) Nitrate nitrogen (mg/100g) in soil accounts for mineralization in soils. It helps to understand the level of productivity of soil. All three grades of high, medium and low types of concentration have been found in wetlands under consideration.

(4) Ammoniacal nitrogen (mg/100g) in soil is a measure for the amount of ammonia present in soil. It determines soil productivity. 36-50 mg/100g of soil is considered to be high, while 21 mg/100g or less is taken as low concentration. In areas where nitrogen is high, ammoniacal nitrogen has also been found to be high and vice versa.

(5) Phosphate (mg/100g) in soil is another measure for soil fertility because phosphorous is essential for all living organisms for growth and maturity. There are only two - high and low – grades of concentration of phosphate in wetlands of the study area (Fig.3).

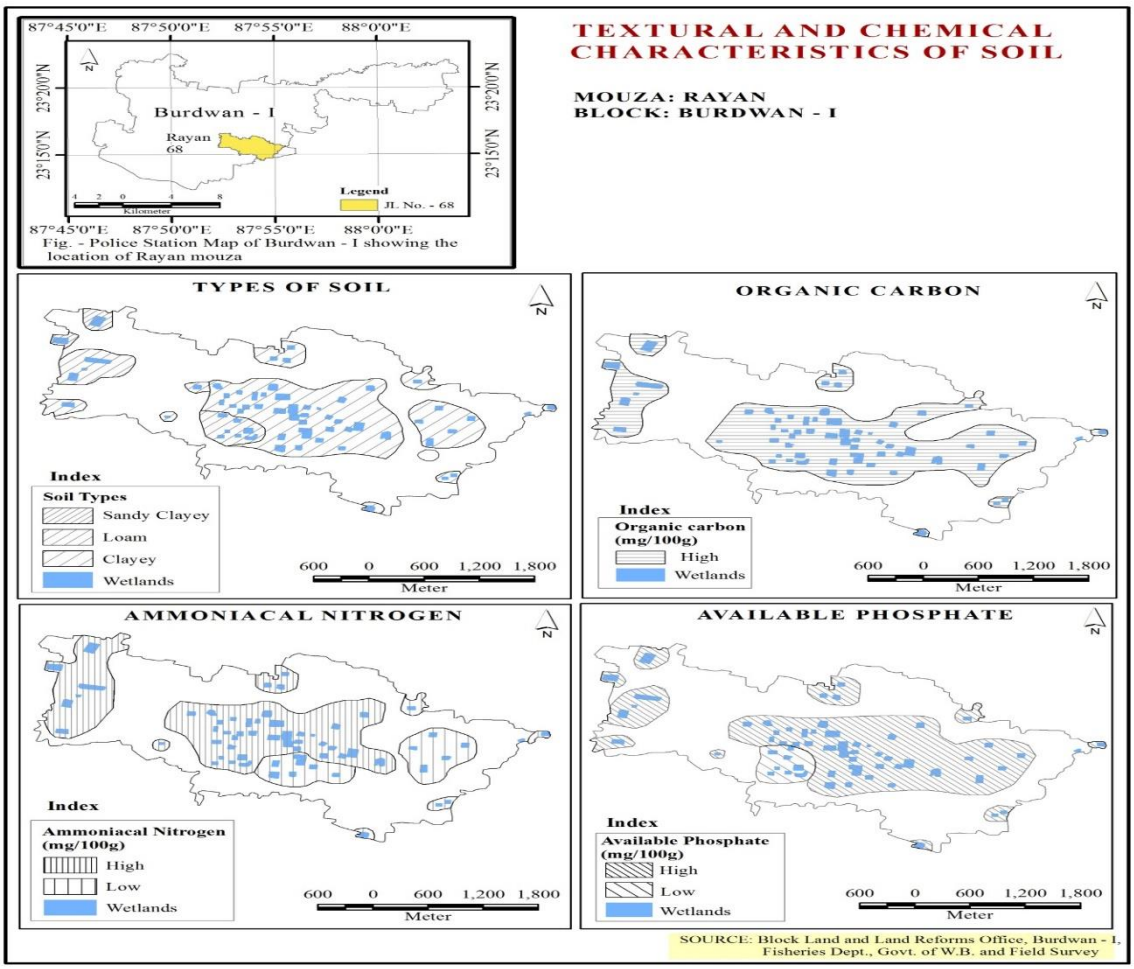

Fig3:Mouza – Rayan, Block – Burdwan I

6.3 COMBINED PRODUCTIVITY OF WATER AND SOIL

Based on the above observations on water and soil in wetlands of the study area, a combined productivity assessment of water and soil, as per the combined productivity scale given in Table 3, has been done for all 64 wetlands (Fig.4). Combined productivity of medium type has been observed for 18 wetlands (28.13%) and high productivity prevails for 46 wetlands (71.87%) of the study area as outlined in Table 6.

Table 6: Combined productivity and functional nature of wetlands of study area

Combined productivity of water and soil	Productivity score	No. of wetland	Number of wetland (%)
Low	<6	-	
Medium	6-12	18	28.13
High	12-18	46	71.87
		64	100.00

Source: Based on Table nos. 3

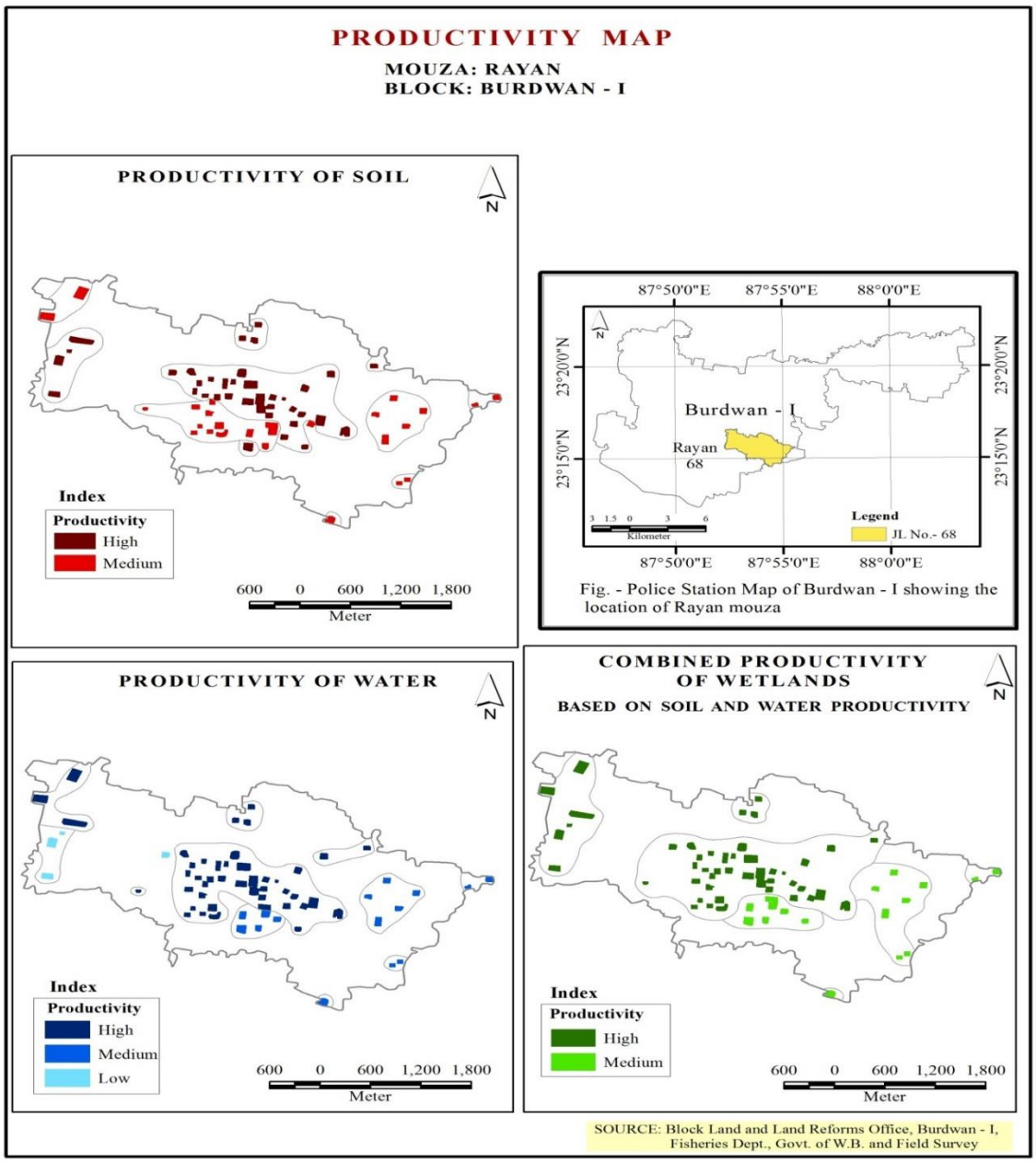

Fig.4: Mouza – Rayan, Block – Burdwan I

As the combined productivity of water and soil varies from High to Medium to Low in the study area, it is untenable that all wetlands are productive to all kinds of aquatic resources. Hence, a study on the prospect of resource potentiality through combined productivity of water and soil has been undertaken as follows. Table 7 refers to the suitability of cultivation of different types of aquatic macrophytes under available conditions of water and soil.

Table 7: Resource potentiality based on observed physical and chemical conditions of water and soil: Medium productivity

Resource Potentiality	Physical and chemical properties (water & soil)	Range
Cultivation of fodder plus cultivation of lotus, medicinal plants and plants for non-conventional food including *Trapa bispinosa* (Roxb.) [Paniphal]	Depth	0.6-1.2 meter
	Temperature	15-32^0 C
	Type of soil	Loam - Clayey loam
	pH(water)	6-7.5
	Dissolved oxygen	1.5 – 3.0 (mg/litre)
	Total alkalinity	50 – 100(mg/litre)
	Phosphate	0.1 - 1.0 (mg/litre)
	Organic carbon (mg/ 100g)	1-2
	Ammoniacal Nitrogen (mg/ 100g)	21-36

Moreover, the physico-chemical characteristics of water and soil of the wetlands have also been found suitable for pisciculture, as outlined in (Table no. 8). These conditions prevail in most of the High productive wetlands of the study area.

Table 8: Resource Potentiality of pisciculture based on observed physical and chemical conditions of water: High productivity

Resource Potentiality	Physical and chemical properties of water	Range
Pisciculture (Indian Major Carp and other fresh water varieties plus Fish seed)	Depth	1.5-2.0 metre
	Temperature	25-30^{0}C
	Transparency	30-40 cm
	pH (water)	7.5-8.5
	Total alkalinity	80 – 150(mg/litre)
	Dissolved oxygen	5-7 (mg/litre)
	Dissolved carbon-dioxide	5 – 15(mg/litre)
	pH (soil)	6.5-7.5
	Organic carbon	1.5- 2.5 (mg/ 100g)
	Nitrogen	50-70(mg/100gm)

There are about 14 species of fresh water prawns which are potential from culture point of view (Sukla and Upadhyay,2009; Sathanam,1987; Jhingran, 1997). These species are *Nephros norvegicus* (commonly called Scampi), *Macrobrachium rosenbergii*,*Palaemon fluminicola*,*Palaemon styliferus*,*Metapenaeus affinis*,*Parapenaeopsis sculptilis* (rainbow shrimp)etc.*Nephros norvegicus*(Scampi) is popular among the fishermen in West Bengal. Prawn is suitable for cultivation in wetlands of medium to high productivity in study area (Table 9).

Table 9: Resource Potentiality of prawn culture based on observed physical and chemical conditions of water and soil: High - medium productivity

Resource Potentiality	Physical and chemical properties Of water	Range
Prawn culture [*Nephros norvegicus*(Scampi) and others]	Depth	1 meter
	Temperature	25-33^0 C
	Transparency	30-40 cm
	Colour	Slight greenish
	pH(water)	7.0 -8.5
	Total alkalinity	50 – 100(mg/litre)

Resource potentialities of wetlands are an expression to highlight the availability of numerous resources from wetlands, hitherto under-utilized, on the basis of availability of renewable biological diversity in them. This is with a view to capability enhancement in economic sphere of the study area. From the above studies it has been observed that the study area has enormous potentialities of resource use and resource creation, leading to both income and employment generation.

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